2.0 DATA EVALUATION

Samples of soil, house dust, tap water, groundwater, homegrown vegetables, sediment, surface water, fish, and plants (i.e., water potatoes) have been collected in the Coeur d'Alene River Basin. Because of the large quantity of analytical data available, the data were organized into a form appropriate for the baseline human health risk assessment (HHRA) according to the following procedure:

1. The data were sorted by medium and geographical area.
2. A baseline HHRA data set was developed.
3. The methods used for sample analysis were evaluated.
4. The data quality was evaluated with respect to sample quantitation limits, qualifiers and codes, and blanks.
5. Chemicals of Potential Concern (COPCs) were identified using a decision process that included a comparison of detected chemical concentrations with screening values (SV).

2.1   BASIN GEOGRAPHICAL AREAS

For the purpose of the remedial investigation/feasibility study (RI/FS), the Coeur d'Alene Basin has been divided into five geographical areas, called conceptual site model (CSM) units. Because these divisions were developed for use in the RI and Eco RA, and not for the HHRA, not all of these divisions are applicable to the HHRA. Therefore, these divisions were further broken down into geographic subareas to more clearly reflect human exposure areas. The following section discusses each of the five CSM Units and briefly describes the geographic subareas associated with each CSM Unit. These geographic subareas and the specific human exposure areas evaluated within each subarea are discussed in further detail in Section 3 and Appendix N. The purpose of this section is to provide consistency between the HHRA, the Eco RA, and the RI.

The Coeur d'Alene Basin has been divided into the following five CSM Units:

! CSM Unit 1: Upper Watersheds (including Beaver Creek, Big Creek, Canyon Creek, Moon Creek, Nine Mile Creek, Pine Creek, Prichard Creek, and Upper South Fork Coeur d'Alene River [from here on referred to as Upper South Fork]),
! CSM Unit 2: Midgradient Watersheds (including South Fork Coeur d'Alene River [from here on referred to as the South Fork], North Fork Coeur d'Alene River [from here on referred to as the North Fork], and Coeur d'Alene River),
! CSM Unit 3: Lower Coeur d'Alene River and Flood plain,
! CSM Unit 4: Coeur d'Alene Lake, and
! CSM Unit 5: Spokane River.

These CSM units were defined as part of a Basinwide CSM developed by the Ecological Risk Assessment Work Group (CH2M HILL 1998). Each CSM unit is further broken down into stream

segments based on stream drainage areas and morphology. Not all watersheds and/or stream segments have human populations, nor do they all have significant contamination. CSM Units 1, 2, and 3 were selected as applicable to this baseline HHRA. Human health concerns in CSM Unit 4 were addressed in the *Expedited Screening Level Risk Assessment for Common Use Areas* (provided as Appendix B), with the exception of Blackwell Island, which is included in this baseline HHRA, and Harrison Beach, which is included in the discussion of CSM Unit 3 (Section 2.1.3). CSM Unit 5 (Spokane River) has been evaluated separately. Maps showing the stream segments in CSM Units 1, 2, and 3 are provided in Figures 2-1 and 2-2. Because much of the sample data for the Basin have been segregated by watershed, the initial evaluation of available data is discussed within the context of the CSM units for the purposes of selecting data and COPCs. In Section 3, new geographical areas are selected that are more applicable to human health.

Appendix C provides an evaluation of potential exposure to residents for each stream segment. Table 2-1 provides a summary of the CSM units, geographical subareas, and segments, and indicates whether relevant data have been collected and included in the baseline HHRA for that segment. The following sections discuss each of the CSM units in more detail.

2.1.1   CSM Unit 1

Twelve of the 24 stream segments in CSM Unit 1 have not been included in the baseline HHRA. The following excluded stream segments include:

!   Those minimally impacted by mining activities (as determined by the number of source areas within and upstream of the segment) and thus likely to have low contaminant concentrations (segments listed in Table 2-1 as "relatively uncontaminated"),

!   Those at which there are no residential populations and where little or no routine recreational use is anticipated, and

!   Those relatively inaccessible to humans (e.g., limited roads and difficult terrain).

No EPA data were available for 10 of the 12 excluded segments. These segments are in areas that fit the exclusion criteria listed above (i.e., they have been minimally impacted by mining and have minimal residential or recreational populations); therefore, the lack of data does not constitute a data gap for the HHRA. There are non-EPA data available for many of these segments; however, these data are not applicable to the HHRA for the reasons stated. Figure 2-1 shows the stream segments located in CSM Unit 1. The segments excluded from the baseline HHRA are shown with the segment name underlined. The data collected in CSM Unit 1 that is included in this HHRA falls within the geographic areas of Mullan, Burke/Nine Mile, and portions of the Side Gulches and Kingston. These areas are further defined in Section 3.

2.1.2   CSM Unit 2

Two of the four stream segments in CSM Unit 2 have been included in the baseline HHRA. MidGradSeg03 was excluded because it comprises the North Fork and is minimally impacted by mining. MidGradSeg02 was excluded because it consists mainly of the 21-square-mile area referred to as the Bunker Hill Superfund site, which is being addressed in another investigation. (See Appendix C for a detailed summary of the segments.) The geographic subareas that are encompassed in CSM Unit 2, as outlined in Section 3, are Wallace, Silverton, Osburn, and part of the Side Gulches and Kingston.

2.1.3   CSM Unit 3

All six segments located in CSM Unit 3 have been included in the baseline HHRA. Harrison Beach (considered part of CSM Unit 4 in Appendix B) has been included with CSM Unit 3 in the baseline HHRA because it is located near the mouth of the lower Coeur d'Alene River, in LCDRSeg06 (Figure 2-2), and the metal concentrations in sediment at Harrison Beach are similar to those at the other locations in CSM Unit 3. The data from CSM Unit 3 is considered in the Lower Basin subarea.

2.1.4   CSM Unit 4

The expedited screening level risk assessment for common use areas (Appendix B) examined beaches around Coeur d'Alene Lake that are used by the public. None of the beaches had metal concentrations greater than the levels of potential concern for human health, with the exception of Blackwell Island. Concentrations of metals in sediment on Blackwell Island warranted further evaluation of this area in the baseline HHRA. All data from Blackwell Island were previously screened in the expedited risk assessment (Appendix B); therefore, data from Blackwell Island are not included in the selection of COPCs in this section. The COPCs selected in Section 2.5 are evaluated at Blackwell Island in subsequent sections of the report (Section 3) and are grouped in the Lower Basin geographic subarea. Although, Lake Coeur d'Alene sites were screened out as an area of concern for the general population, there may be a concern with tribal populations consuming fish. Concern for potential health threats associated with tribal fish consumption are warranted for the following reasons:

- C   Tribal consumption rates of fish caught from Lake Coeur d'Alene are expected to be higher than other groups fishing the Lake.
- C   Tribal members traditionally consumed whole fish which can have concentrations of metals approximately an order of magnitude greater than filleted fish.
- C   The Washington Department of Health has advised against consuming whole fish from the upper Spokane River.

However, data are not available for tribal exposures to fish from the Lake. Therefore, whole fish from Lake Coeur d'Alene is a data gap that has been identified as a future requirement.

2.1.5   CSM Unit 5

CSM Unit 5 is comprised of the Spokane River. Human health concerns for the Spokane River were evaluated separately in the *Draft Final Screening Level Human Health Risk Assessment for Nonresidential Receptors* (USEPA 2000d). In 1999, whole-body and fillet fish samples were collected from the Spokane River by the Washington State Department of Ecology for use in the ecological risk assessment. Whole body fish data from CSM Unit 5 was used in the baseline human health risk assessment to estimate tribal exposures to lead through consumption of whole fish caught from Lake Coeur d'Alene (See Section 2.2.1). However, the fish ingestion pathway was not evaluated in the *Draft Final Screening Level Human Health Risk Assessment for Nonresidential Receptors*.

2.2   SELECTION OF DATA USED IN HHRA

2.2.1   Environmental Data

In the extensive sampling efforts that have occurred in the Coeur d'Alene River Basin, samples have been collected from a variety of environmental media, including soil, house dust, tap water, groundwater, sediment, surface water, and various plant and animal tissues (including homegrown vegetables, fish, and water potatoes). The locations of nonresidential soil, sediment, surface water, and groundwater samples used in the risk calculations are shown in Figures 3-12 through 3-26 in Section 3. Residential data are not shown on these figures because of confidentiality agreements with homeowners; however, residential data are included in the risk calculations for the COPCs selected in Section 2.4.

Data collected by investigators other than the EPA have generally not been included in the baseline HHRA. Because the EPA has conducted sampling investigations specifically for purposes of assessing human health risks, these data were preferentially selected over historical data collected by others and for potentially different purposes. However, data from the Coeur d'Alene Tribe and the State of Idaho were used where applicable.

As of the summer of 1999, the EPA had completed 11 sampling events for various media in the Coeur d'Alene River Basin. These sampling events are referred to in this report by their field sampling plan addendum (FSPA) numbers (e.g., FSPA No.1). Eight of these sampling events produced data applicable to the baseline HHRA.

A summary of each sampling event is included in the RI report for the Coeur d'Alene Basin. Data resulting from the implementation of FSPA Nos. 2,3,4,5,6,7,8, and 12 have been included in the baseline HHRA. The following provides a brief summary of the exposure areas for the FSPAs used in baseline HHRA. Section 3.1.4 further characterizes exposure area by exposure scenario and geographical subarea.

C   The sampling for FSPA Nos. 2, 3, and 4 was not planned for human health purposes. The samples were collected for purposes of site characterization, not specifically for human health risk assessment. Consequently, the sampling locations and methods differ somewhat from

those used during the implementation of FSPA Nos. 5, 6, 7, 8, and 12, which were designed to meet HHRA requirements. Therefore, no defined exposure area exists for these FSPAs because the sampling results were not intended for use in the baseline HHRA. This data was used to provide some generic information on potential risks from surface water and sediment exposures in the Osburn, Silverton and Wallace combined, Nine Mile, Canyon Creek, and Mullan areas. This information was used to evaluate neighborhood risks and, in general, sample locations were within a relatively short distance (approximately 2 miles) of at least one residence. The use of this data is further discussed in the uncertainty section, Section 7.

C   FSPA No. 5 was the sampling of common use areas and included the sampling of upland parks in Silverton and Wallace in CSM Unit 2, the common use areas along the lower Coeur d'Alene River in CSM Unit 3 (Lower Basin), and beach common use areas around Lake Coeur d'Alene (CSM Unit 4). The beaches around the Lake were previously evaluated in the expedited screening level risk assessment for common use areas (Appendix B), as mentioned in Section 2.1.4. Blackwell Island and Harrison Beach are the only common use areas from the screening level risk assessment that are evaluated in the HHRA because they are the only beaches that had metals concentrations above the screening level, warranting further investigation in the HHRA. Because Harrison Beach is located near the mouth of the Lower Coeur d'Alene River, it was evaluated along with the other CUAs in the Lower Basin subarea. Blackwell Island, however, was evaluated as its own geographical subarea. The exposure areas for the CUAs were defined as the area that people use (i.e., ball fields, parks, etc.) Therefore, the actual exposure areas varied on a site by site basis. As an example of how the exposure areas were defined, refer the representative photographs and sampling location maps for Blackwell Island and Harrison Beach in Appendices A and B of the expedited screening level risk assessment (Appendix B).

C   The FSPA Nos. 6, 7, and 12 sampling events were the residential samplings. The exposure areas for these FSPAs varied from residence to residence and were defined by the property boundaries of the yard area.

C   FSPA No. 8 included the sampling of five waste piles and groundwater in source areas. The waste piles were sampled as part of the evaluation of neighborhood recreational exposures because local children were known to play on the sampled waste piles located near their homes. Waste piles were sampled purposively to provide generic information on potential waste piles exposures.

Because of the large extent of the Basin study area, it was not possible to sample every single location where exposures might occur. Exposure areas were grouped into geographical subareas in order to give an idea of what typical exposures might be. Even though risks and hazards are evaluated by geographical subarea (See Section 5), risk management decisions will be made on a site by site basis. No risk management decisions will be made in the absence of data.

Data resulting from the implementation of FSPA Nos. 1, 9, 10, and 11 have not been included. FSPA No. 1 involved sediment coring from transects in the lateral lakes; however, samples collected from adjacent locations during FSPA No. 5 consisted of surface sediments along the shoreline and were,

therefore, more appropriate to the evaluation of human exposure. FSPA No. 9 entailed hyperspectral-imaging work. FSPA No. 10 sampling efforts are applicable only to the ecological risk assessment. FSPA No. 11 consisted of data gap sampling not applicable to the risk assessment.

In the summer of 1996, the Idaho Department of Health and Welfare (IDHW) conducted a study (IDHW 2000) that characterized both environmental contamination and biological indices of human exposure within the Basin. During this study, data from 843 residential homes were systematically obtained within the Basin. The data obtained from the IDHW study included yard soil, house mat dust, house vacuum dust, lead-based paint measurements, and tap water. All samples collected were originally analyzed for lead and cadmium. Additional analyses of a subset of the soil data for other metals (e.g., arsenic, mercury, and zinc) have been completed for approximately 80 homes and these were included in the risk calculations for the non-lead metals in addition to the EPA residential data.

In July of 1999, a strategy was adopted to augment the existing database with new information sufficient to support site-specific analysis and provide the risk assessment effort with appropriate information to characterize lead exposure in the Basin. Those public areas, communities, and specific media for which little data were available were sampled in the summer of 1999 by the State of Idaho. A supplemental survey was also conducted by the State of Idaho in November of 1999, that collected environmental samples and survey data from the homes of those children providing blood lead results that had not previously been sampled. Of the 132 homes that were not included in previous efforts, approximately 90 of those homes were sampled in the fall 1999 survey.

The samples from the IDHW study, all EPA residential data, and additional residential data collected by the State of Idaho in the summer and fall of 1999 are included in the lead risk assessment section. The methodology and justification for combining the data sets for the site-specific lead analysis is summarized in the Yard Soil section; the technical memorandum is provided in Appendix N.

Data from fish tissue collected by the State of Idaho and whole fish collected by the State of Washington for the Spokane River RI/FS have been included in the baseline HHRA. Data from water potato samples collected by the Coeur d'Alene Tribe have also been included for application to the traditional and modern tribal scenarios. Water potato data collection methodology is included in Appendix S.

Data from adits were not included because human exposure to water from adits is anticipated to be minimal. Adits are generally located in areas with limited potential for human access and most of them are fenced to prevent human entry. Any unfenced adits will be fenced as part of remediation activities, further limiting exposure.

Yard Soil

Prior to combining the existing data sets for use in the risk assessment, statistical analysis were performed to determine if the data were compatible. Due to the similarities in field sampling protocol of

the FSPA06, FSPA07, and FSPA12 surveys, these data sets were combined by the USEPA. However, the 1996 IDHW/ATSDR study was conducted under a different protocol than that used in the three USEPA surveys. These protocols differ in two major aspects, the sampling methodologies employed and selection of homes. Homes were self-identified based upon a voluntary call-in basis in the USEPA surveys, whereas the IDHW/ATSDR study homes were selected randomly, although the service was offered to everyone.

To evaluate whether the field sampling and analytical techniques used in the surveys produce similar results, surface soil lead and cadmium concentrations from 23 homes common to both the IDHW/ATSDR and the USEPA surveys were compared. The results suggest a strong correlation between the two survey results, but lead concentrations determined by the USEPA protocols may be higher than that observed in IDHW/ATSDR survey. However, this difference, was not apparent for cadmium and the magnitude of the increase is likely not indicative of significant methodological differences between the two protocols with respect to exposure point concentrations and risk calculations for other metals. As a result, surface soil results from the two surveys were combined for additional analysis for metals other than lead. Appendix N provides the methodology and justification for combining the data sets for the site-specific lead analysis.

Several subareas were under-represented in the USEPA surveys. As a result, 89 IDHW/ATSDR samples were retrieved from archives and submitted for re-analysis. Two groups were re-analyzed; 24 samples were analyzed through the EPA CLP and 65 samples were re-analyzed at a private laboratory under contract with the State of Idaho. Statistical evaluations suggested that analytical results were reproducible for lead and cadmium, and that it was appropriate to use the new archive results to characterize other metals concentrations in soils for the risk assessment.

Non-Lead Metals. Soil samples were collected from 191 residential yards in the Coeur d'Alene Basin and analyzed for 23 inorganics. Eighty of these homes were sampled by the State of Idaho, the other 111 homes were sampled by the EPA during work under FSPA Nos. 6, 7, and 12. Both surface and shallow subsurface soil samples were collected. Under the EPA sampling protocol, a minimum of 20 composite samples were collected from five areas at each property. This methodology provided individual sampling locations representing an area in the yard, rather than a single point, thus reducing the potential for anomalous low or high outliers. In addition, discrete areas of the yard with potentially high exposures, i.e., vegetable gardens, children's play areas, gravel driveways, and downspouts were also sampled.

Prior to analysis, soil and house dust samples were sieved through an 80-mesh sieve to capture the fraction less than 175-µm in diameter following American Society for Testing and Materials (ASTM) Method D-422 and the portion that passed through the sieve was analyzed for total metals. The samples were sieved to produce particles of the size expected to adhere to skin (Kissel, Richter, and Fenske 1996a; Duggan and Inskip1985; Que Hee et al. 1985). The size fraction of 175 µm was selected as the most appropriate for evaluating human health exposures for the following reasons:

C   Humans receive their greatest exposure to sediments from inadvertent soil ingestion via hand-to-mouth activity resulting from soil adhered to skin (and possibly clothing and objects such as toys).

C   A review of scientific literature has identified an upper cut-off size range for dermal particle adherence of 150 to 250 μm (USEPA 2000c).

C   The 175-μm size fraction has been used in health risk analyses in the Coeur d'Alene Basin. Using the 175-μm fraction provides comparability with comprehensive soil data collected from upstream mining and smelting sources.

C   The 175-μm size fraction has been used in geochemical-exploration studies conducted by the USGS to define naturally occurring levels of metals in soil and rock. Using the 175-μm fraction provides comparability with comprehensive soil and mineral data collected by Gott and Cathrall (1980).

C   The 175-μm size fraction is compatible (and protective) for use in the IEUBK Model. The model was validated and calibrated using soil concentration inputs based on the fraction less 250 μm (Hogan et al. 1998).

C   Empirical data for determining soil bioavailability for lead for the IEUBK Model is based on studies using the less than 250-μm size fraction (USEPA 2000c, Maddaloni et al. 1998; Casteel et al. 1997).

Lead. Approximately 1020 homes throughout the Basin from the 1996 IDHW, FSPA Nos. 6, 7, and 12, and the 1999 State of Idaho surveys had yard soil data analyzed for lead. In addition, discrete areas of the yard with potentially high exposures, i.e., vegetable gardens, children's play areas, gravel driveways, and downspouts were also sampled. All yard soil samples were sieved to retain particles of less than 175-μm diameter, as discussed above.

House Dust

Non-Lead Metals. Dust samples from floor mats and vacuum cleaner bags were collected from residences throughout the Coeur d'Alene Basin. Eighty-three mat samples and 77 vacuum bag samples were collected and analyzed for 23 inorganics. For 16 of the mat samples from FSPA Nos. 6, 7, and 12, strict adherence to mat handling protocols did not occur. These data are included in the risk assessment for lead and the implications of mishandling are further discussed in Section 7. Generally, the data from the mat samples could underestimate the dust loading because homeowners cleaned the mats, rolled them up, or held them up vertically.

Lead. Dust mats were placed and collected from about 500 homes throughout the Basin and vacuum bag samples were collected from approximately 320 homes for lead analysis during the 1996 IDHW, FSPA Nos. 6, 7, and 12, and the 1999 State of Idaho surveys. Vacuum bag samples give a general representation of lead concentration in the home, while dust mats provide both concentration and a dust loading rate (i.e., grams of dust/m^2/day), and lead loading rate (i.e., mg of lead/m^2/day). Two of the 24 dust mat samples from the 1999 State of Idaho survey were qualified because mat handling protocols by the residents were not followed. Therefore, only 2 mats are known to have been tampered with by

residents. Because 1996 was the first year dust mat sampling was performed, difficulties in quantifying the number of mats tampered with by the residents were encountered.

Tap Water

Non-Lead Metals. Tap water samples were collected from 100 homes and analyzed for 23 inorganic constituents. Forty of the homes were supplied with water from a private source (i.e., a well, a seep or a spring, or surface water). The other 60 homes were supplied with water from a public water supply system. Samples included both first-run and flushed-line tap water. The first-run tap water sample was collected at the beginning of the day, before water had been flushed through the pipes. The flushed-line samples were collected after water had been allowed to run for 10 minutes. Flushing allows metals that might have leached out of the water pipes in a home to be flushed from the water system. Tap water samples were collected under FSPA Nos. 6 and 12.

Lead. A total of about 200 first-run and about 425 flushed-line tap water samples were analyzed for lead throughout the Basin from homes using both a private source and homes using a public water supply system. These samples were collected in the 1996 IDHW, FSPA Nos. 6 and 12, and the 1999 State of Idaho surveys.

Lead-Based Paint

XRF measurements on approximately 415 homes were collected in the 1996 IDHW survey. Lead concentration in interior and exterior surfaces were collected. These data were used to determine if a relationship existed with dust and blood lead levels. These data were not used in the non-lead portion of the analysis.

Groundwater

Eighty groundwater samples were collected from 27 monitoring wells surrounding selected source areas near Nine Mile and Canyon Creeks as part of FSPA No. 8. The groundwater samples were analyzed for 23 inorganics. The groundwater is not currently being used as drinking water, which is obtained from shallow wells up in the side canyons of the two creeks; however, the data were used to quantify a future drinking water use scenario. The use of groundwater as drinking water was the only future scenario evaluated, because all other land use conditions are assumed to remain the same.

Homegrown Vegetables

During work under FSPA No. 6, vegetables were opportunistically collected from 24 residential gardens, after permission was granted by the homeowners. Samples included aboveground produce such as lettuce, basil, cauliflower, cabbage, rhubarb, corn, kohlrabi, and spearmint and root produce such as potatoes, carrots, beets, radishes, and onions. Lettuce, carrots, and potatoes were the most

frequently sampled vegetables. All produce samples were analyzed for arsenic, cadmium, and lead, because these metals were presumed to be good indicator chemicals for health risks from produce. Arsenic and lead were selected because of their toxicity and concentrations in soil. Cadmium was selected because of its toxicity and ability to bioaccumulate in plants.

Upland Soil

Parks, Schools, and Day Care Centers. More than 900 soil samples were collected at 13 upland parks, schools, and day care centers in Silverton and Wallace and analyzed for use in the risk calculations during work under FSPA No. 5. The parks and facilities in Silverton were the following:

> !   Satner Field, Silverton School District,
> !   Huggie Bear Day Care,
> !   Silverton Ball Field near Huggie Bear,
> !   Silverton T-ball/Wellman Field,
> !   Silverton T-ball/Wellman Field Park, and
> !   Silverton T-ball/Wellman & Satner Fields parking lot.

The parks and facilities in Wallace were the following:

> !   Small city park near schools,
> !   Wallace Library,
> !   Wallace City Park (monument),
> !   Wallace Depot,
> !   Canyon Avenue Park,
> !   Wallace Visitors Center & parking lot, and
> !   Wallace High School & Grammar School playground.

Soil samples were collected from a depth of 0 to 1 inch. In grassy areas, sod was removed and soil was collected both from the root zone and down to the 1-inch depth. Prior to analysis, the soil samples were sieved (Kissel, Richter, and Fenske 1996a).

Waste Piles. Many waste piles are located throughout the Coeur d'Alene Basin. As stated in USEPA 1989, "contamination may be unevenly distributed across a site, resulting in hot spots (areas of high contamination relative to other areas of the site). If a hot spot is located near an area which, because of site or population characteristics, is visited or used more frequently, exposure to the hot spot should be addressed separately." These waste piles are considered to be hot spots as described above and young children have been observed playing on these piles or were reported as having played on them; therefore, piles were sampled "purposively" in order to estimate risks resulting from exposure to waste piles. Purposive sampling is that in which the investigator chooses the sampling location, whereas random and systematic sampling are independent of the investigator and are considered unbiased. While purposive sampling is generally not recommended for risk assessment evaluations, it is

considered an acceptable sampling method for "evaluation of visually obvious contamination" (USEPA 1989), such as waste piles.

Twenty-seven surface soil samples were collected from five waste piles associated with particular mines in the Canyon Creek, Nine Mile Creek, and Mullan areas during FSPA No. 8. The mines Tamarack #7 and Tiger Poorman are located along Canyon Creek, Rex Reach/Reach #2 and Success are along Nine Mile Creek, and the Morning Mine waste dump is on the outskirts of Mullan. Given the large number of waste piles in the Basin, these five were sampled to give a representative understanding of metals concentrations in waste piles. Many waste piles that are accessible on the valley floor and some of the side canyons do receive heavy use by teenagers and adults, although the pile may not be easily accessible by younger children. Therefore, many of the more remote piles do provide exposure and will be evaluated during the remedial design phase although the risk assessment did not quantitatively evaluate these piles.

Because of the rocky nature of the waste piles, not enough fines could be collected from the 0- to 1-inch-depth interval for sieving. Therefore, rather than collecting samples from both the 0- to 1-inch and 1- to 6-inch-depth intervals, samples were collected only from the 0- to 6-inch interval and sieved prior to analysis. The assumption is that the 0- to 6-inch interval is representative of the concentration in the top inch.

Floodplain Soil and Sediment

Approximately 480 samples of Flood plain soil and/or sediment were collected from various locations throughout the Coeur d'Alene Basin during FSPA Nos. 3 and 5. Sediment samples were collected under FSPA No. 3 over a variety of depths to 4 feet below ground surface (bgs). Data from surface sediment samples were selected for inclusion in the baseline HHRA. The results of sediment sampling under FSPA No. 3 (South Fork, Canyon Creek, and Nine Mile Creek) are based on bulk, rather than sieved, samples and sampling locations were not based on human use patterns, because this sampling effort was not initially intended for use in the human health portion of the risk assessment. This data was used because no more human health data was available. Because the samples were not sieved prior to analysis, it likely under-estimates concentrations at these three river segments.

Work under FSPA No. 5 included sampling of soil and sediment in the Flood plain of the lower Coeur d'Alene River. Samples were collected from areas known to be used by the public. Soil/sediment in areas where only surficial play was expected were collected (generally picnic areas a short distance up from the water) from a depth of 0 to 1 inch. Dry sediment along beaches was sampled to a depth of 12 inches. Sediment in the wading portion of the beach (waterline to a water depth of 3 feet) was sampled, at a depth of 0 to 6 inches. Samples were sieved prior to analysis.

Surface Water

Surface water samples were collected from the South Fork and the majority of the large tributary streams: Canyon Creek, Nine Mile Creek, Big Creek, Moon Creek, Beaver Creek, and Pine Creek under FSPA Nos. 2 and 4. These sample collection locations were selected for the purpose of site characterization, not for the evaluation of human health risks.

Subsequently, "disturbed" surface water samples under FSPA No. 5 were collected from the lower Coeur d'Alene River specifically for the HHRA. Disturbed surface water is surface water that contains suspended sediment due to active disturbance of the water by the sampler. These disturbed samples were collected at shallow-water beach locations with a low or moderate slope. Steeply sloped beaches were not sampled based on the assumption that individuals are unlikely to attempt to wade on steeply sloped beaches. Before collecting the surface water samples, the field crew disturbed the sediments (i.e., kicked up sediments into the water column with their feet) in an effort to mimic surface water conditions during water play activities; thus, water samples were randomly collected from the area of dirty water and contained large amounts of suspended sediments. In contrast to previous surface water sampling in other locations, the sampling locations for the human health risk assessment were based on human use patterns of the water bodies.

For subsistence lifestyle exposure scenarios, in addition to disturbed water samples, undisturbed surface water samples were collected in the Lower Basin. The assumption is that tribal members collect undisturbed surface water as their drinking water source. Undisturbed surface water samples were analyzed for 23 metals.

Surface water data for total metals (rather than dissolved metals) were selected for use in the baseline HHRA. Total metals were used in the HHRA for the following reasons:

> ! Human health toxicity criteria consider total exposure regardless of dissolved versus total form, and
> ! Humans are exposed via incidental ingestion of the total fraction in water.

Fish Tissue

From 1995 through 1997, the State of Idaho and the Coeur d'Alene Tribe collected fish samples, which were filleted prior to analysis. Data from 312 fish fillet samples from three different species (bullhead, perch, and northern pike) were used in the HHRA. The fish were collected from Killarney, Medicine, and Thompson Lakes, all of which are part of the lateral lakes area of the Coeur d'Alene Basin. Fish tissues were analyzed for mercury, lead, and cadmium. As discussed in Section 2.2.5 for vegetables, indicator chemicals in fish tissue were selected for analysis based on their toxicity and persistence (i.e., ability to bioaccumulate).

Tribal populations traditionally consumed whole fish caught from Lake Coeur d'Alene. Therefore, whole body fish samples represent the fish ingestion pathway for tribal members more accurately than the fillet tissue for the tribal scenarios used in this HHRA. However, as discussed in Section 2.1.4,

whole fish data from the lake is not available, but some whole-body data from the Spokane River is available for lead. In 1999, 67 fish were collected from the Spokane River by the Washington State Department of Ecology. Of the 67 fish, 54 were filleted and then analyzed and 13 whole body fish were analyzed for lead. The fish species collected were wild rainbow trout, hatchery rainbow trout, large scale sucker, mountain whitefish, and crayfish (Johnson 2000). The results from this effort were intended for the ecological portion of the Spokane River RI/FS, but the data are used in lead risk calculations in this human health risk assessment for tribal scenarios for consumption of whole fish. However, there is great uncertainty surrounding these risk and hazard estimates. Extrapolation of hazards and risks associated with fish in Lake Coeur d'Alene from lateral lakes fillet data and Spokane whole fish data is not recommended for a number of reasons. While species with similar feeding habits were compared between the two environments, their exposure pathways to contaminated sediment are different. For example, because the dynamic river environment offers a greater variety of feeding habitats, a bottom feeding river fish is less likely to ingest contaminated sediments than a bottom feeding fish in the uniform depositional environment of the lateral lakes. Similarly, although they share similar feeding habits, the prey base for trout in the river environment is less exposed overall to depositional environments than that for perch in the lakes. In addition, different species bioaccumulate metals at different rates. Therefore, human exposure to metals through consumption of fish may vary with species being consumed. Thus, neither fish data from the lateral lakes nor fish data from Spokane River are likely representative of fish in Lake Coeur d'Alene.

Concern for potential health threats associated with tribal fish consumption is warranted for the following reasons:

C Tribal consumption rates of fish caught from Lake Coeur d'Alene are expected to be higher than other groups fishing the Lake.
C Tribal members traditionally consumed whole fish which can have concentrations of metals approximately an order of magnitude greater than filleted fish.
C The Washington Department of Health has advised against consuming whole fish from the upper Spokane River.

However, data are not available for tribal exposures to fish from the Lake. Therefore, whole fish from Lake Coeur d'Alene is a data gap that has been identified as a future requirement.

Water Potatoes

The Coeur d'Alene Tribe traditionally eats water potatoes harvested from the lower Coeur d'Alene River. In 1994, the tribe collected 95 samples of water potatoes from the lower Coeur d'Alene River and analyzed them for metals, both with skin and without skin. The report regarding collection of water potato data is included as Appendix S. The available data include concentrations of the following detected metals in water potatoes: aluminum, cadmium, lead, manganese, iron, and zinc.

2.2.2 Biological Data

The Idaho Department of Health and Welfare (IDHW) and the Agency for Toxic Substances and Disease Registry (ATSDR) and the Panhandle Health District (PHD) have conducted fixed site blood lead screening in upper and lower basin communities from 1996-1999. The IDHW/ATSDR study was undertaken in the summer of 1996 and the three lead health surveys were conducted by the local PHD in 1997, 1998, and 1999. The IDHW/ATSDR study included blood draws for lead analysis and urine cadmium analysis for both adults and children; the PHD surveys were voluntary child blood lead screenings. A total of 524 children aged 9 months through 9 years have provided venous blood lead samples over the four years. Confidentiality of these data are protected under Idaho State law. However, a redacted blood lead data set is available in Appendix T. The data from these surveys are further discussed in Section 6.

2.3   DATA QUALITY

2.3.1   Data Quality Objectives/Data Quality Assessment

EPA has standard procedures for how data quality shall be assessed in Human Health Risk Assessments. These procedures are outlined in EPA's Data Quality Objectives (DQO) Process Guidance (USEPA 1994d) and Data Quality Assessment (DQA) guidance (USEPA 1998e). These guidance documents were followed and are discussed in varying degrees in the individual FSPAs and the RI/FS. The following is a brief summary of how these guidance documents were applied to the Baseline HHRA. See Section 4.2 of Part 1 of the RI for more a detailed discussion.

The purpose of the 1994 DQO process guidance is to provide general guidance to organizations on developing data quality criteria and performance specifications for decision making. The DQO process is a strategic planning approach that provides a systematic procedure for defining the criteria that a data collection design should satisfy, including when, where, and how many samples to collect and the tolerable level of decision errors for the study. The seven step DQO process was considered and documented in the Draft Technical Work Plan (URS Greiner and CH2M Hill 1998), and considered further and documented in varying degrees in the individual FSPAs developed from 1997 through 2000. Each FSPA and USGS task was developed to address specific data gaps identified after reviewing available historical data and results of previous sampling and analysis efforts. The purpose of each data collection effort was to investigate areas potentially impacted by mining related activities. Due to the large geographic extent of the study area, it was not possible to fully characterize all areas. As all data gaps were not addressed, subsequent studies of specific areas identified for remedial actions may be needed to support remedial design efforts.

The DQA process is a comparison of the implemented sampling approach and the resulting analytical data against the sampling and data quality requirements specified by the DQOs. Results of the DQA are used to determine whether data are of adequate quality and quantity to support the decision-making process. The data quality assessment performed for this study includes evaluation of the quality of the analytical data generated for each of the field sampling efforts and evaluation of the adequacy of the data collected during this study, samples were submitted to commercial laboratories or to EPA for

analysis using the EAPs contract laboratory program (CLP) methods or the EPA SW-846 methods. High quality is maintained in these programs through the use of on-site audits, performance evaluation samples, quarterly performance reports, fraud detection mechanisms, performance based scheduling and continuous inspection of laboratory data. Additionally, all analytical data were validated according to EPA data validation guidance (USEPA 1994e). Following validations, the data set was further reviewed for proper application of data qualifiers. Data identified during validation as being unacceptable for project uses were not carried forward in the assessment.

The sampling plans were designed to provide data to decide if areas are impacted with a high degree of certainty. Since data can only estimate what the true condition of an area is, decisions that are based on measurement data could be in error. Risk assessment requires a high degree of certainty in the supporting data; therefore, field sampling and analysis plans developed to collect data specifically to support the human health risk assessment included sample collection designs with a known confidence level (95 or 99 percent) for the majority of common use area sampling. Specifying confidence levels in advance of sampling is important when defining sites where it is difficult to determine if an area has been impacted by contamination (average concentration close to screening values). Where historical information clearly indicates areas are contaminated (average concentration much greater than screening value), specifying confidence intervals prior to sampling is unnecessary because the chances of falsely characterizing the area are very low. For example, historical data have demonstrated that the waste piles in the Basin contain contaminated soil. Subsequent sampling events have confirmed the initial assumption.

2.3.2 Data Usability

Optimizing data useability in baseline human health risk assessments reduces uncertainty in environmental data used in risk assessment. The 1992, Final Guidance for Data Usabiltiy in Risk Assessment (USEPA 1992e) provides practical guidance on how to obtain an appropriate level of quality of all environmental analytical data required for Superfund human health risk assessments. The following section briefly describes the Data Usability guidance and how it was applied to the HHRA.

The four data application questions requiring an answer for risk assessment from the 1992 guidance are as follows:

1. What contamination is present, and at what levels? - The extent of contamination in the Basin is addressed in Section 2.2 which describes sample collection methods, data analysis procedures, and notes where samples were collected specifically for human health needs versus other uses. The vast majority of the data used in the HHRA was collected based on human health considerations and fulfills the requirements of risk assessment guidance as described in USEPA 1989 and USEPA 1992e. For the relatively small amount of data used that was not collected for HHRA use (sediment and surface water data in the South Fork, Canyon Creek, and Nine Mile Creek), the uncertainties associated with these data are discussed in both Section 2 and in Section 7. Other than the data noted above and the special case of waste piles, all samples

were collected using a randomized or systematic sample design appropriate for risk assessment evaluations.

2.   Are site concentrations different from background? - Background samples provide baseline measurements to determine the degree of contamination. Background samples are collected and analyzed for each medium of concern in the same manner as other site samples and require the same degree of quality control and data review. Section 2.4.2 presents background concentrations for all applicable media, except groundwater, for comparisons with site concentrations as part of the COPC screening process. The results of the COPC screening are presented in Section 2.5.

3.   Are all exposure pathways and areas identified and examined? - The nature of the exposure pathways and areas to be examined is critical to the selection of a sampling design and analytical methods. If the pathways and areas are not identified properly, the resulting characterization may be inappropriate. Exposure pathways are identified and discussed in Section 3.2 in detail. In addition, exposure pathways are illustrated in the conceptual site model diagrams in Figures 3-3 through 3-11.

4.   Are all exposure areas fully characterized? - For all exposure areas to be fully characterized, sampling must be representative and must satisfy performance objectives determined during the planning process. Human health exposure areas are discussed and characterized by FSPA in Section 2.2.1 and by exposure scenario and geographical area in Section 3.1.4. However, they were not explicitly defined in many cases due to the large and complex area of the Basin. Additional data may be required to support remedial design and remedial action activities on a site-by-site basis for individual subareas of the Basin.

2.3.3 Evaluation of Sample Quantitation Limits

Some chemicals for which samples were analyzed were not detected in a sample. These "nondetected" chemicals may be present at a concentration just below the reported sample quantitation limit, or they may not be present in the sample at all. In determining the concentrations most representative of potential exposures at the site, the detected concentrations of a chemical were considered together with one-half of the sample quantitation limit for nondetections.

The adequacy of quantitation limits was evaluated by comparing the sample quantitation limits for each chemical in each environmental medium to risk-based screening values. If a sample quantitation limit was less than the risk-based screening value, it was considered adequate. If sample quantitation limit is greater than the SV, risk may be either overestimated or underestimated. Chemicals with sample quantitation limits greater than the corresponding SV were antimony, arsenic, mercury, and thallium. The number of nondetected values greater than SVs and the total number of nondetected samples for these four chemicals are listed in Table 2-2. Sample quantitation limits greater than SVs may be a concern for chemicals that are not selected because those chemicals might be present elsewhere at levels that warrant a health concern. If a chemical, whose SV is less than the sample quantitation limit, is not selected as a COPC, then one would not know whether or not the chemical is present in concentrations above the level of health concern in future analysis. Antimony, arsenic, and mercury

were selected as COPCs; thallium was not. Potential underestimation of health risks due to not selecting thallium is further discussed in Section 7.

2.4   SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Typically, not all chemicals present at a site pose health risks or contribute significantly to overall site risks. EPA guidelines recommend the selection of a group of COPCs based on their inherent toxicity, their concentration at the site, and their behavior in the environment (USEPA 1989).

The occurrence, distribution, and selection of COPCs are presented in EPA's required format (USEPA 1998c), Risk Assessment Guidance, Part D, Table 2 series (Appendix A). The purpose of these tables is to provide the following:

!   Information useful for evaluating the detected chemicals, e.g., frequency of detection and maximum concentration,
!   Chemical screening levels, and
!   Rationale for selection of COPCs.

The EPA, Part D, Table 2 series (Appendix A) also includes information on potentially applicable or relevant and appropriate requirements (ARARs) for comparison purposes. Although COPCs are primarily selected based on human toxicity, in some cases, ARARs may influence the selection of COPCs. The selected ARARs for groundwater and tap water are the EPA Maximum Contaminant Levels (MCLs), which are the legal limits of chemical concentrations allowed in drinking water. The selected ARARs for surface water are the MCLs and the Ambient Water Quality Criteria (AWQC). AWQC are standards used as the basis for controlling discharges or releases of pollutants (USEPA 1998d). AWQC values that are protective of humans consuming fish are provided in the tables as more applicable than AWQC values that are protective of humans who both consume fish and drink the surface water. Surface water bodies in the Coeur d'Alene Basin are not used as a source of drinking water; however, individuals may inadvertently ingest surface water during recreational activities (e.g., wading or swimming). No ARARs are available for soil or sediment. No ARARs are available for air, except for the National Ambient Air Quality Criterion (NAAQC) for lead.

2.4.1   COPC Screening Process

COPCs were selected for soil/sediment, tap water, surface water, groundwater, house dust, and air. For other media, including homegrown vegetables, fish, and water potatoes, all detected metals were considered COPCs and were evaluated quantitatively in the baseline HHRA.

For purposes of COPC selection, all soil and sediment data were combined, including yard soil, upland soil, waste piles, and stream and river sediments.

The screening process consisted of the following steps:

1. Comparison of chemical concentrations in soil/sediment, tap water, surface water, and groundwater to background concentrations,
2. Identification of chemicals that are essential nutrients and/or nontoxic to humans,
3. Determination of the frequency of chemical detection,
4. For noncarcinogens, comparison of the maximum detected chemical concentration in a particular medium with an SV of 0.1 of the risk-based preliminary remediation goal (PRG); for carcinogens (only arsenic), comparison of the maximum detected concentration with a SV, which is equal to the PRG,
5. If the maximum detected concentration exceeds the SV, evaluation of the frequency and magnitude of the exceedance,
6. Comparison of the maximum detected chemical concentration with the PRG, and
7. If the maximum detected chemical concentration exceeds the PRG, evaluation of the frequency and magnitude of the exceedance.

These steps are described in more detail in the following sections.

2.4.2   Comparison to Background Concentrations

The term background is used here to refer to chemical concentrations that would be expected in the Coeur d'Alene Basin in the absence of historical and ongoing emissions from local mining, smelting, and other ore processing operations. The EPA defines background for inorganic chemicals as "…the concentration of inorganics found in soils or sediments surrounding a waste site, but which are not influenced by site activities or releases" (USEPA 1995c). The potential background concentrations provided in the following subsections for soil/sediment, surface water, and groundwater should be considered preliminary. Background concentrations have been calculated for the RI/FS of the Coeur d'Alene Basin. These background concentrations are discussed below for soil and surface water.

The background concentrations discussed in this section and summarized in Table 2-3 were used for purposes of comparison only. The selected COPCs all exceeded background throughout the entire Basin or a major portion of the Basin (i.e., an entire CSM unit).

Background Concentrations in Soil and Sediment

The primary source used for soil and sediment background concentrations in most previous health risk assessments for the 21-square-mile area commonly referred to as the Bunker Hill Superfund Site (BHSS) and the Coeur d'Alene Basin is the Gott and Cathrall study (Gott and Cathrall 1980). This study analyzed the less than 175 micron fraction of 8,700 soil samples in a 300-square-mile area centered on the Coeur d'Alene Basin. Table 2-3 provides the 90th percentile values of the data for all geologic formations in the area. These levels are considered representative of undisturbed pre-mining soils in the entire Coeur d'Alene Basin. These values were used for comparison with site soil and

sediment concentrations in the baseline HHRA, with the exception of lead and cadmium. Lead and cadmium background concentrations are changed slightly from the values presented in Gott and Cathrall (1980). They are based on a more rigorous statistical analysis of Gott and Cathrall's data by Le Jeune and Cacela (1999). The Le Jeune and Cacela cadmium and lead background concentrations are being used in the Basin RI/FS.

Separate background concentrations were developed for sediments around Coeur d'Alene Lake, as reported in the expedited screening level risk assessment for common use areas, (Appendix B). Derivation of those values followed recent state of California guidelines (CalEPA 1992). National guidance detailing procedures for the selection of background values in soil is not available. Although the background sediment concentrations reported in the expedited screening level risk assessment were very similar to the Gott and Cathrall 90th percentile values, the Gott and Cathrall values were selected for the baseline HHRA because they are considered more representative of the study area.

Background Concentrations in Surface Water

Background concentrations of metals in surface water in the Coeur d'Alene Basin were calculated using the approach described in Appendix C of Maest et al. (1999). Using this approach, EPA accounted for differences in mineralization and watershed properties to determine "baseline" concentrations of total cadmium, lead, and zinc in four portions of the Coeur d'Alene Basin: the Upper South Fork, the Page-Galena mineral belt, the Pine Creek drainage, and the entire South Fork Coeur d'Alene River basin. Surface water background concentrations were developed as part of the RI for the Basin and are presented in Table 2-3.

Background Concentrations in Groundwater

Sufficient data to estimate groundwater background concentrations are not available. Total metals concentrations are used in the HHRA and totals were not available for groundwater background concentrations. Only limited dissolved background concentrations were available and these are discussed here for comparison purposes only. Groundwater has been sampled at 116 locations north of the Palouse River in Idaho (Parliman, Seitz, and Jones 1980). Groundwater was sampled at only seven locations in the Coeur d'Alene River valley upstream from Cataldo. Six of the seven locations were potentially impacted by mining activities, whereas the seventh location, on the North Fork, may be indicative of background concentrations. However, these samples were analyzed for dissolved inorganics rather than total inorganics. Concentrations of mercury, molybdenum, selenium, and vanadium were determined to be "negligible"; however, the sample quantitation limits were not reported. The results of these analyses for dissolved arsenic, cadmium, chromium, copper, iron, lead, and zinc for the North Fork monitoring well are reported in Table 2-3. The potential background concentration for arsenic in groundwater from Parliman, Seitz, and Jones (1980) is discussed in Section 2.5.2. However, because these concentrations are dissolved, they are not directly comparable to the concentrations of total metals presented in the Part D, Table 2 series (Appendix A). Therefore, these groundwater sampling data (Parliman, Seitz, and Jones 1980) are not included in the Part D tables.

2.4.3   Essential Nutrients

Under normal circumstances, the following chemicals are not associated with toxicity to humans: aluminum, calcium, iron, magnesium, potassium, and sodium (USEPA 1998e). With the exception of iron, these chemicals are not considered for inclusion as COPCs. Iron screening values were calculated using a provisional reference dose (RfD) derived from a no-observed-adverse-effect level (NOAEL) based on iron levels in the U.S. population from the second National Health and Nutrition Examination Survey (NHANES II) database (USEPA 1999e). Iron was included as a COPC because of the magnitude and number of exceedances over screening levels (see Section 2.5).

Like iron, aluminum also has a provisional RfD and a calculated soil PRG in the EPA Region 9 PRG tables. However, aluminum was excluded as a COPC. Aluminum was excluded from consideration as a COPC for two main reasons: (1) no concentrations exceed EPA Region 9 PRGs (USEPA 1999c), and (2) concentrations are likely within background for northern Idaho (Shacklett and Boerngen 1984). The impacts of excluding aluminum from the risk assessment are discussed further in the uncertainty section of this report (Section 7).

2.4.4   Frequency of Detection

EPA guidance allows the elimination of chemicals from the quantitative evaluation if they are detected infrequently and the magnitude of exceedance is not a concern (USEPA 1989). In this assessment, a frequency of detection of 5 percent was used as a criterion for the elimination of chemicals as COPCs. In other words, if a chemical was detected in fewer than 5 percent of the samples for a particular medium, it was eliminated as a COPC if the magnitude of exceedance (of the PRG) was not a concern. In all cases, chemicals were detected in greater than 5 percent of the samples.

2.4.5   Comparison to Screening Values and Risk-Based Preliminary Remediation Goals

Soil, Sediment, Tap Water, and Groundwater

Maximum detected concentrations of chemicals in each medium were compared to SVs and risk-based PRGs. PRGs are defined as the residential values listed in EPA Region 9 PRG tables (USEPA 1999c); they represent concentrations in soil, air, and tap water that correspond to a 1 in 1,000,000 (1 x 10^{-6}) cancer risk (for carcinogenic chemicals) or a noncancer hazard quotient of 1.0 (for noncarcinogenic chemicals). Residential soil PRGs are protective of the ingestion, dermal contact, and inhalation exposure pathways. Residential tap water PRGs are protective of the ingestion pathway. SVs for carcinogens are the same as the corresponding PRG. For chemicals with noncarcinogenic toxicity, however, SVs are defined as 0.1 of the corresponding PRG. The use of 0.1 of EPA Region 9 PRGs for noncarcinogens allows for a more protective screening process by accounting for the additive toxicity of multiple contaminants and follows EPA Region 10 guidelines (USEPA 1998e). Soil PRGs and SVs were used for screening soil and sediment data; tap water PRGs and SVs were used for screening tap water, groundwater, and surface water data.

If the maximum detected concentration of a chemical in a particular medium (soil/sediment, tap water, surface water, or groundwater) did not exceed the SV, the chemical was eliminated as a COPC in that medium. If the maximum detected concentration exceeded the SV, then the frequency and magnitude of exceedance were evaluated. Chemicals with less than 10 percent of the data exceeding the SV and no exceedances of the PRG were eliminated as COPCs. Chemicals with more than 10 percent of their data exceeding the SV were further evaluated by considering the distribution of the concentrations and the frequency of exceedances over the PRG.

Surface Water

Because there are no applicable SVs for surface water that is not used as drinking water, MCLs and AWQC were selected as appropriate SVs. AWQC were preferentially used, if available, as they are closer to approximating the human use of the water body (the selected AWQC are protective against eating fish from the surface water). If a chemical had no AWQC (only 7 of the 23 inorganics have an AWQC), it was screened against the MCL.

Air

Although the residential PRGs for soil include an inhalation component, a separate SV for air was calculated for comparison to the soil and sediment data in the absence of site-specific air data. The SVs for the air pathway were estimated using a default particulate emission factor (PEF), as recommended by the EPA (USEPA 1996b). The PEF relates the chemical concentration in soil with the concentration of dust particles in the air due to fugitive dust emissions from surface-contaminated sites. Particulate emissions are caused by wind erosion and, therefore, depend on the erodibility of the surface material. The EPA used default assumptions for wind speed and the percent vegetation to calculate a PEF value. The default PEF value of 1.32×10^9 m^3/kg (USEPA 1996b) was used to calculate the air pathway SVs for all metals that had inhalation toxicity criteria. The default value was used as a protective approach to screening. Calculations for the air SVs are found in Table 2-4. Chemicals with less than 10 percent of the data exceeding the SV and no exceedances of the PRG were eliminated as COPCs. Chemicals with more than 10 percent of their data exceeding the SV were further evaluated by considering the distribution of the concentrations and the frequency of exceedances over the PRG.

2.5   RESULTS OF COPC SCREENING

The following subsections describe the results of the screening process for each medium, including the rationale for selecting or eliminating chemicals as COPCs. Tables 2-5 through 2-10 show all chemicals detected at concentrations greater than the SVs in more than 10 percent of the samples.

2.5.1 Soil/Sediment

Approximately 4,000 soil and sediment samples were collected within the study area and analyzed for 23 inorganics (Tables 2.1.1, 2.2.1, and 2.3.1 in Appendix A). The tables in Appendix A separate samples by CSM unit for soil/sediment, tap water, and surface water to show differences between CSM units; however, differences in chemical concentration were relatively minimal. Samples were collected from residential yards, common use areas (i.e., public areas), waste rock piles, and stream/river sediments. Thirteen metals were detected at least once at a concentration greater than the SV. The metals with at least one sample but less than 10 percent of the samples exceeding the SV were barium, copper, silver, and vanadium. These chemicals had frequencies of exceedance of 2.4, 3.8, 2.6, and 0.8 percent, respectively. However, concentrations of only nine of these metals exceeded the SV in more than 10 percent of the samples (Table 2-5): antimony, arsenic, cadmium, iron, lead, manganese, mercury, thallium, and zinc.

Seven metals were selected as COPCs in soil/sediment:

- ! Antimony,
- ! Arsenic,
- ! Cadmium,
- ! Iron,
- ! Lead,
- ! Manganese, and
- ! Zinc.

Six metals (antimony, arsenic, cadmium, iron, lead, and manganese) were selected as COPCs in soil and sediment based on the magnitude and frequency of their exceedances over their respective SVs and PRGs. Iron and manganese concentrations exceeded their 90th percentile background concentrations of 65,000 mg/kg and 3,600 mg/kg in only 9 percent and 11 percent of all soil/sediment samples, respectively. Approximately 10 percent of the data would be expected to exceed the 90th percentile value. Although iron and manganese concentrations in CSM Units 1 and 2 may be within the range of natural background, 68 percent of the iron concentrations and 77 percent of manganese concentrations in CSM Unit 3 exceeded their background concentrations (65,000 mg/kg and 3,600 mg/kg, respectively). Therefore, iron and manganese were selected as COPCs based on exceedances of SVs in all CSM units and exceedances of background in CSM Unit 3.

Three metals (mercury, thallium, and zinc) had relatively low frequencies of exceedance over their respective SVs (13 percent to 15 percent) and very low frequencies of exceedance over their PRGs (less than 1 percent). However, zinc was selected as a COPC because of its historical association with mining activities in the Basin and its prominence in the ecological risk assessment being conducted concurrently with the HHRA. Nevertheless, zinc concentrations are unlikely to contribute significantly to human health risks when compared with the other selected metals. Mercury and thallium were not selected as COPCs in soil and sediment for the following reasons:

! The concentrations of these metals exceeded their respective PRGs with a low frequency less than one percent.

! Histograms of their concentration distribution (Appendix D) indicate the majority of the data are well below the SV; thus, exposures to these metals would not contribute significantly to health risks (hazard quotients of 0.1 or less) in comparison to the other metals.

! Mercury was excluded as a COPC in soil and sediment because exposure to mercury through direct ingestion of soil is not an apparent health concern. However, mercury has the ability to bioconcentrate up the food chain. Therefore, human exposures to mercury may occur through consumption of other organisms (i.e., fish) which are exposed to mercury in soil and sediment. This issue was addressed by selecting mercury as a COPC in the fish ingestion pathway   (Section 2.5.7).

The potential underestimation of health risks due to the exclusion of mercury and thallium is discussed in Section 7. In general, floodplain soils/sediments in CSM Unit 3 had the highest concentrations of metals, with the exception of waste piles.

2.5.2   Tap Water

One hundred and two samples of first-run tap water were collected from 100 homes; 100 samples of flushed-line tap water were collected from 100 homes (Tables 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.3.2, and 2.3.3 in Appendix A). The first-run samples were expected to produce the highest concentration of metals that might leach from water pipes and solder in pipe joints. With the exception of lead, human exposure to chemicals from home plumbing is outside the scope of this risk assessment.

In first-run samples, nine metals were detected at least once at a concentration greater than the SV: antimony, arsenic, cadmium, copper, iron, lead, nickel, thallium, and zinc. In flushed-line tap water samples nine metals were detected at least once at a concentration greater than the SV: antimony, arsenic, cadmium, copper, iron, lead, manganese, thallium, and zinc. In the first-run samples, concentrations of four of the metals exceeded the SV in more than 10 percent of the samples: arsenic, cadmium, copper, and lead (Table 2-6). In the flushed-line sample, concentrations of one metal (arsenic), exceeded the SV in more than 10 percent of the samples (Table 2-7). MCLs are also provided in the tables for discussion purposes because the water samples are from home taps currently being used for drinking water. MCLs are the legal limits for chemicals in drinking water.

Two metals were selected as COPCs in tap water:

! Arsenic, and
! Lead.

The sample quantitation limit for arsenic was greater than the SV in 100 percent of the nondetected samples collected from tap water because the SV is not technically achievable. The lowest sample

quantitation limit was 0.2 µg/L, four times the SV (Table 2-2). Therefore, wherever arsenic was detected, it was detected above the SV and it is uncertain whether the arsenic concentrations in nondetected samples are greater than or less than the SV. Arsenic was detected in approximately 44 percent of the samples.

In the Parliman, Seitz, and Jones study (1980), one sample (from a water supply well in the town of Mullan possibly unimpacted by mining) out of seven samples had dissolved fractions of arsenic detected at a concentration of 1 µg/L. Analytical results for a water sample collected from a well on the North Fork, also likely unimpacted by mining, indicated an arsenic concentration of "0" and the detection limit was not reported. Another sample collected from a well within the Bunker Hill Superfund site (likely mining-impacted) had a dissolved arsenic concentration of 8 µg/L. Arsenic was not detected in the other four wells and the detection limits were not reported. Dissolved fraction concentrations should be lower than total concentrations indicating that arsenic in tap water from a groundwater source is potentially at background; however, the background sample size is extremely small. In general, arsenic in municipally supplied water (groundwater source) was detected at concentrations less than 0.6 µg/L (total concentration), although some detection limits for the nondetected samples were as high as 1.7 µg/L. Arsenic concentrations, on average, were higher in privately supplied water, with detected concentrations ranging from 0.3 µg/L to 9.2 µg/L.

Although arsenic concentrations are below the MCL (the legal limit for drinking water) and potentially at background levels, arsenic was selected as a COPC in tap water because of its exceedance of the SV and the uncertainties surrounding its detection limit.

Risk assessment procedures for lead consider all the lead an individual might encounter in his or her environment regardless of the source. Therefore, all measurements of lead in tap water are evaluated as part of the lead risk assessment regardless of the water source or whether the concentrations exceeded an SV. The Guidance Manual for the IEUBK Model recommends using an average of first draw and flushed tap water samples (USEPA 1994a). Both first draw and flushed tap water samples were collected in FSPA Nos. 6, 7, and 12 and the 1999 State of Idaho Surveys regardless of the source of water. However, in the 1996 IDHW survey, only well water samples were collected from a point as close to the well head as possible and preferably before any holding tanks or filter systems.

Copper was excluded as a COPC because exceedances of the SV were limited to first-run samples, indicating a plumbing issue rather than a mining-related issue. Copper concentrations in only 4 percent of the first-run samples exceeded the PRG and the concentration in only one flushed-line sample exceeded the SV (0.1 percent).

Cadmium was excluded as a COPC because of its relatively low frequency of exceedance of the SV (12 percent) and the PRG (0.1 percent, only one sample) in first-run samples and because exceedances of the SV in flushed-line samples were only 7 percent.

2.5.3   Surface Water

Up to 379 surface water samples were collected and analyzed for 23 inorganics (Tables 2.1.4, 2.2.4, and 2.3.4 in Appendix A). These samples were collected from stream/river locations throughout CSM Units 1, 2, and 3. Of the 379 samples, 130 consisted of "disturbed" surface water containing actively stirred up sediment, and the rest were collected without active sediment disturbance.

Fifteen metals were detected at least once at a concentration greater than the SV. Nine of these metals had frequencies of exceedance of the SV of less than 2 percent. Concentrations of five of these metals exceeded the SV in more than 10 percent of the samples (Table 2-8). All five were selected as COPCs in surface water for both "disturbed" and "undisturbed" water conditions:

- ! Arsenic,
- ! Cadmium,
- ! Lead,
- ! Manganese, and
- ! Mercury.

For the metals that were not selected, the frequencies of exceedance of the SVs were less than 2 percent. Concentrations of antimony and zinc did exceed the MCL in more than 10 percent of the samples; however, the AWQC when available are more applicable SVs for water that is not used as drinking water (Section 2.4.5).

Mercury in nondisturbed water samples (all locations except the lower Coeur d'Alene River), was detected in only 3 percent of the samples at concentrations less than the SV. Because sediments could be stirred up during water play activities (i.e., water becomes "disturbed"), mercury was selected as a COPC in surface water for all locations.

2.5.4   Groundwater

Approximately 84 groundwater samples were collected and analyzed for 23 inorganics (Table 2.1.5 in Appendix A). These samples were collected from monitoring wells surrounding selected source areas in CSM Unit 1. Groundwater results are included for screening for the purpose of a future tap water use scenario, because the groundwater is not currently being used as drinking water (groundwater used as municipal supply water is from a different aquifer). Eleven metals were detected at least once at a concentration greater than the SV and concentrations of six of the metals exceeded the SV in 10 percent or more of the samples (Table 2-9). Five of these metals were selected as COPCs (all but manganese):

- ! Antimony,
- ! Arsenic,
- ! Cadmium,

!   Lead, and

!   Zinc.

Concentrations of manganese exceeded the SV in 16 percent of the samples and exceeded the PRG in 4 percent of the samples. However, manganese was not selected as a COPC because of the low frequency of exceedance of the SV (indicating the majority of the data are below the SV) and the PRG (less than 3 percent). It should be noted that manganese concentrations exceeded a secondary MCL in 25 percent of the samples, that could be an issue if the groundwater was ever developed as a drinking water source. The secondary MCL for manganese is less than the SV. Secondary MCLs are not health based. The potential underestimation of risk due to the exclusion of manganese as a COPC in groundwater is discussed in the uncertainty section (Section 7).

2.5.5   House Dust

The chemicals selected as COPCs in outdoor soil were automatically selected as COPCs in house dust because, with the exception of lead, the source of mining-related chemicals in house dust is assumed to be outdoor soil (Table 2.4.1 in Appendix A). To ensure that no additional COPCs should be selected for house dust and to verify that the concentrations of chemicals selected in outdoor soil also exceeded the SVs for indoor dust, house dust concentrations were screened using soil SVs. There were 160 samples of house dust from floor mats and vacuum bags, representing the 83 homes available for screening.

The detected chemicals and frequencies of exceedances of the SVs in dust are similar to those seen for soil. Fourteen metals were detected in dust at least once at a concentration greater than the SV. Thirteen of these metals were the same ones that exceeded the SVs in soil. The additional metal in dust (nickel) was detected at a concentration exceeding the SV in only one sample, a frequency well below 10 percent. In dust, as in soil, the concentrations of nine metals exceeded the SV in more than 10 percent of the samples (Table 2-10). Eight of the nine metals in dust were the same as those in soil: antimony, arsenic, cadmium, iron, lead, manganese, mercury, and zinc. The ninth metal was copper.

Seven metals were selected as COPCs in house dust:

!   Antimony,

!   Arsenic,

!   Cadmium,

!   Iron,

!   Lead,

!   Manganese, and

!   Zinc.

Copper and mercury had relatively low frequencies of exceedance (15 and 14 percent, respectively) of the SVs and no exceedances of the PRGs; consequently, they were not selected as COPCs in house dust according to the same rationale described for soil in Section 2.5.1.

Lead in house dust is evaluated in Section 6.0. Vacuum bag dust lead is used in the IEUBK Model analysis. Dust mat samples were not used as input to the model. In the case of a missing vacuum bag dust sample, the average dust lead concentration for that community was used. Dust mat samples have not typically been evaluated in the IEUBK Model.

2.5.6 Air

All soil and sediment samples collected within CSM Units 1, 2, and 3 were combined to evaluate the air pathway (Table 2.4.2 in Appendix A). Approximately 4,200 soil and sediment samples were collected and analyzed for 23 inorganics. These samples were collected from residential homes, common use areas, waste rock piles, and stream/river sediments. Arsenic and manganese were the two chemicals detected at a concentration greater than the SV in at least one sample; however, the frequency of the exceedances were less than 10 percent (Table 2-11). Due to the low percentage of exceedances, these two chemicals were excluded as COPCs for the air pathway. Regardless of its concentrations, lead was selected as a COPC in air to be quantitatively evaluated in the lead model.

2.5.7 Fish

No COPC screening was performed for fish tissue data because no appropriate SVs were available (Table 2.4.4 in Appendix A). All chemicals analyzed in fish were considered COPCs:

- ! Cadmium,
- ! Lead, and
- ! Mercury.

2.5.8 Homegrown Vegetables

No COPC screening was performed for homegrown vegetables. All produce samples were analyzed for arsenic, cadmium, and lead (Table 2.4.3 in Appendix A). The COPCs selected for homegrown vegetables to be evaluated quantitatively in the baseline HHRA are the following.

- ! Arsenic,
- ! Cadmium, and
- ! Lead.

2.5.9 Water Potatoes

No comparison of detected chemicals to SVs was performed for water potatoes because of a lack of appropriate SVs. Cadmium and lead were selected as indicator COPCs to be consistent with the other food chain samples, vegetables and fish (Table 2.3.5 in Appendix A). The other metals selected as COPCs in soil for which there are analytical data in water potatoes (manganese, iron, and zinc) are unlikely to contribute significantly to health risks due to water potato ingestion in comparison to direct ingestion of soil and sediment.

2.6   SUMMARY OF CHEMICALS OF POTENTIAL CONCERN

Chemicals were selected as COPCs if they exceeded screening values that were based on residential exposures. For the general population, residential exposures would be the highest that would be expected for any media. However, the risk assessment also evaluated subsistence exposures. The special subsistence population could potentially have exposures to media greater than residential populations. Thus some chemicals, which were screened out, might present a health risk for the subsistence populations. This issue is further discussed in Section 7.2.1. Table 2-12 summarizes the COPCs selected in each medium for quantitative evaluation in the baseline HHRA.